

WHAT IS CLAIMED IS:

1. A distance measurement apparatus comprising:
 - electromagnetic wave generating means for generating and
 - 5 transmitting an electromagnetic wave;
 - scanning means for periodically changing a direction in which the electromagnetic wave is transmitted from the electromagnetic wave generating means;
 - receiving means for receiving an echo wave caused by
 - 10 reflection of the electromagnetic wave at an obstacle;
 - first driving means for repetitively driving the electromagnetic wave generating means a plurality of times per one period of the change of the direction by the scanning means, and thereby for causing the electromagnetic wave generating means to
 - 15 repetitively generate and transmit a distance measurement electromagnetic wave;
 - first calculating means for measuring a time interval between a moment of every generation and transmission of the distance measurement electromagnetic wave by the electromagnetic wave
 - 20 generating means in response to drive by the first driving means to a moment of reception of a corresponding echo wave by the receiving means, and for calculating a distance to an obstacle on the basis of the measured time interval;
 - second driving means for, before the first driving means
 - 25 drives the electromagnetic wave generating means, driving the electromagnetic wave generating means and thereby causing the

electromagnetic wave generating means to generate and transmit a judgment electromagnetic wave having an energy smaller than that of the distance measurement electromagnetic wave; and

obstacle judging means for judging whether an obstacle is
5 present or absent on the basis of conditions of reception of an echo wave corresponding to the judgement electromagnetic wave by the receiving means, for permitting the first driving means to drive the electromagnetic wave generating means next in cases where it is judged that an obstacle is absent, and for inhibiting the first driving
10 means from driving the electromagnetic wave generating means next in cases where it is judged that an obstacle is present.

2. A distance measurement apparatus comprising:

electromagnetic wave generating means for generating and
15 transmitting an electromagnetic wave;

scanning means for periodically changing a direction in which the electromagnetic wave is transmitted from the electromagnetic wave generating means;

receiving means for receiving an echo wave caused by
20 reflection of the electromagnetic wave at an obstacle;

first driving means for repetitively driving the electromagnetic wave generating means a plurality of times per one period of the change of the direction by the scanning means, and thereby for causing the electromagnetic wave generating means to
25 repetitively generate and transmit a distance measurement electromagnetic wave;

first calculating means for measuring a time interval between a moment of every generation and transmission of the distance measurement electromagnetic wave by the electromagnetic wave generating means in response to drive by the first driving means to
5 a moment of reception of a corresponding echo wave by the receiving means, and for calculating a distance to an obstacle on the basis of the measured time interval;

second driving means for, before the driving means drives the electromagnetic wave generating means, driving the
10 electromagnetic wave generating means and thereby causing the electromagnetic wave generating means to generate and transmit a judgment electromagnetic wave having an energy smaller than that of the distance measurement electromagnetic wave; and

obstacle judging means for judging whether an obstacle is
15 present or absent on the basis of conditions of reception of an echo wave corresponding to the judgement electromagnetic wave by the receiving means, for causing the first driving means to drive the electromagnetic wave generating means next to generate and transmit a first distance measurement electromagnetic wave in
20 cases where it is judged that an obstacle is absent, and for causing the first driving means to drive the electromagnetic wave generating means next to generate and transmit a second distance measurement electromagnetic wave in cases where it is judged that an obstacle is present, wherein the second distance measurement
25 electromagnetic wave is lower in energy than the first distance measurement electromagnetic wave.

3. A distance measurement apparatus as recited in claim 2,
wherein the second distance measurement electromagnetic wave is
lower in amplitude than the first distance measurement
5 electromagnetic wave.

4. A distance measurement apparatus as recited in claim 2,
wherein a duration of generation of the second distance
measurement electromagnetic wave is shorter than that of the first
10 distance measurement electromagnetic wave.

5. A distance measurement apparatus as recited in claim 2,
wherein each of the first distance measurement electromagnetic
wave and the second distance measurement electromagnetic wave
15 contains at least one pulse, and a pulse in the second distance
measurement electromagnetic wave is smaller in width than that in
the first distance measurement electromagnetic wave.

6. A distance measurement apparatus as recited in claim 2,
20 wherein each of the first distance measurement electromagnetic
wave and the second distance measurement electromagnetic wave
contains at least one pulse, and the second distance measurement
electromagnetic wave is smaller in pulse number than the first
distance measurement electromagnetic wave.

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7. A distance measurement apparatus as recited in claim 2,

wherein the first distance measurement electromagnetic wave results from modulation in accordance with a pseudo noise code having a first bit length, and the second distance measurement electromagnetic wave results from modulation in accordance with a pseudo noise code having a second bit length smaller than the first bit length.

8. A distance measurement apparatus as recited in claim 2, wherein the obstacle judging means comprises second calculating means for measuring a time interval between a moment of every generation and transmission of the judgement electromagnetic wave by the electromagnetic wave generating means in response to drive by the second driving means to a moment of reception of a corresponding echo wave by the receiving means, and for calculating a distance to an obstacle on the basis of the measured time interval, and judging means for judging whether an obstacle is present in or absent from a prescribed distance range on the basis of the distance calculated by the second calculating means.

9. A distance measurement apparatus comprising:
first means for emitting a first laser beam in a first direction, the first laser beam having a first power;
second means for receiving an echo corresponding to the first laser beam;
third means for determining whether or not the second means receives an echo corresponding to the first laser beam;

fourth means for emitting a second laser beam in the first direction in cases where the third means have determined that the second means receives an echo corresponding to the first laser beam, the second laser beam having a second power;

5 fifth means for emitting a third laser beam in the first direction in cases where the third means have determined that the second means does not receive an echo corresponding to the first laser beam, the third laser beam having a third power, the third power being higher than the first power, the third power being

10 higher than the second power;

sixth means for emitting a fourth laser beam in a second direction after the fourth means emits the second laser beam or the fifth means emits the third laser beam, the second direction being different from the first direction, the fourth laser beam having the

15 first power;

seventh means for receiving an echo corresponding to the fourth laser beam;

eighth means for determining whether or not the seventh means receives an echo corresponding to the fourth laser beam;

20 ninth means for emitting a fifth laser beam in the second direction in cases where the eighth means have determined that the seventh means receives an echo corresponding to the fourth laser beam, the fifth laser beam having the second power; and

tenth means for emitting a sixth laser beam in the second

25 direction in cases where the eighth means have determined that the seventh means does not receive an echo corresponding to the

fourth laser beam, the sixth laser beam having the third power.

10. A distance measurement apparatus comprising:

first means for emitting a first laser beam in a first direction,
5 the first laser beam having a first power;

second means for receiving an echo corresponding to the first
laser beam;

third means for determining whether or not the second
means receives an echo corresponding to the first laser beam;

10 fourth means for emitting a second laser beam in the first
direction in cases where the third means have determined that the
second means does not receive an echo corresponding to the first
laser beam, the second laser beam having a second power higher
than the first power;

15 fifth means for inhibiting the fourth means from emitting the
second laser beam in cases where the third means have determined
that the second means receives an echo corresponding to the first
laser beam;

sixth means for emitting a third laser beam in a second
20 direction after the fourth means emits the second laser beam or the
fifth means inhibits the fourth means from emitting the second
laser beam, the second direction being different from the first
direction, the third laser beam having the first power;

seventh means for receiving an echo corresponding to the
25 third laser beam;

eighth means for determining whether or not the seventh

means receives an echo corresponding to the third laser beam;

ninth means for emitting a fourth laser beam in the second direction in cases where the eighth means have determined that the seventh means does not receive an echo corresponding to the third laser beam, the fourth laser beam having the second power;
5 and

tenth means for inhibiting the ninth means from emitting the fourth laser beam in cases where the eighth means have determined that the seventh means receives an echo corresponding to the third
10 laser beam.